ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue IV, April 2026

Preparation and Study of a Composition Based on Butadiene Nitrile Polymer Using Astragals

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DOI: https://doi.org/10.51583/IJLTEMAS.2026.150400123

Received: 25 April 2026; Accepted: 30 April 2026; Published: 21 May 2026

ABSTRACT

This work is devoted to the topic "Obtaining and studying a composition based on butadiene nitrile polymer using Astragals".

Binary mixtures of butadiene nitrile rubber with astragals in different mass ratios were prepared and the flow index of the system alloy was studied at temperatures of 130, 160, 170 ℃ and under the influence of loads of 12.0-21.0 kg. Our studies have shown that at a temperature of 160 ℃ and when astragals has 5 mass parts in the binary mixture, it acts as a modifier. As a result of the modification, the technological properties of BNK, mainly compatibility with other components and chemical stability, increase by 1.5 times compared to standard resins. We have developed an optimal recipe for obtaining rubbers based on butadiene nitrile rubber and astragals. A rubber mixture was prepared based on the optimal recipe, the vulcanization mode and time were determined, which determined the vulcanization temperature to be 157C and the vulcanization time to be 26 minutest-his work was carried out on the purchase of BNR-based rubber for cables that is chemically resistant to aggressive environments, more perfect and fully capable of meeting operational characteristics, has chemical resistance in saline areas, and is suitable for use as a coating. The main indicators of the obtained regime were determined by physical-mechanical methods and compared with standard rubbers, and it was confirmed that the main indicators of the proposed rubber fully meet the requirements of the standard

Keywords: Astragals, butadiene-nitrile rubber, modification, SKI-analysis, vulcanization, ecology

INTRODUCTION

Nitrile butadiene rubber is one of the main rubbers in the rubber industry. Important rubbers resistant to oil and gasoline are obtained based on NBR. However, some properties of NBR (mainly its poor resistance to ozone and chemical resistance in aggressive environments) limit its application areas [1-8]. Many scientists, in order to reduce these shortcomings of NBR, first used the most modern mixer to obtain rubber compositional [9-11]. Then, 5 parts by weight of antiparticles were added to plasticized NBR and mixed in the same mixer for 5 minutes. To this mixture, ZnO as an activator and altax as an activator were added and mixed again for 5 minutes to obtain a modified composition [12-13]. Other authors, on the other hand, kept the NBR-based rubber composition in an air-circulating oven at 70 °C for 70 hours to study the effect of heat aging [14-19]. These authors carried out the modification of nitrile-butadiene rubber with functional groups [20-22].he main research efforts of researchers have focused on improving the mechanical strength of NBR and have mainly focused on modifying the rubber with chemically functional groups. As a result of the modification, it has been possible to improve the strength and chemical resistance of NBR materials [23-24}. In addition, recent studies have shown that nitrile-butadiene rubber is more durable than PET-based fabrics and has excellent properties [25-29].

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METHOD

We first used astragals to modify nitrile-butadiene rubber. The general appearance of the astragals is shown in Figure 1.



Figure 1 The general appearance astragals

As a result of the research, we determined that the astragals we used contained - Selenium 1.5 mg%. Macro- and micro-elements (calcium, silicon, aluminum, iron, magnesium, cobalt, zinc, copper, manganese, molybdenum, chromium). The chemical formula was determined to be as shown in Figure 2

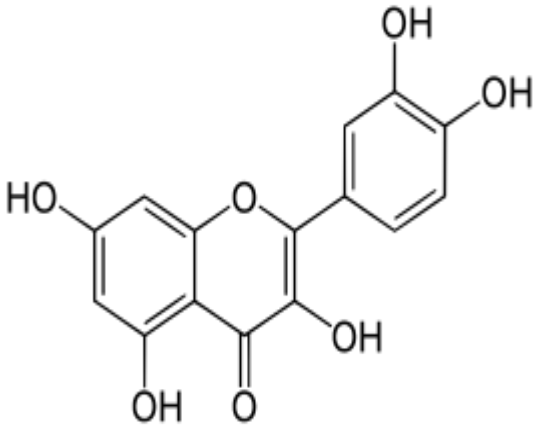


Figure 2. Approximate chemical structure of astragals

Preparation of rubber mixtures

After preparing the rubber mixture according to the recipe with an analytical balance with an accuracy of 99%, the components were added sequentially between the two rotating shafts of the roller in a laboratory roller at

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue IV, April 2026

Balakhani "BAKSHİN" JSC and heated at 1300C for 12 minutes until a homogeneous system was obtained. After the homogeneous system was cooled to 900C, sulfur was added to it to prevent the process of vulcanization.

The research work was carried out using the most modern methods: Differential Thermal Analysis (DTA), Electron Paramagnetic Resonance (EPR). X-ray analysis and determination of the main parameters of the vulcanizate were carried out on the latest model crushing machine.

In order to conduct the research work, the optimal recipe proposed earlier was adopted and the composition mixture was prepared in a laboratory roller.

The composition was obtained in the roller by mixing in the temperature range of 30-60℃ and for 12 minutes. This can be seen more clearly in Table 1(Recipe for making binary systems):

Table 1. Micro volume characteristics of equally mixed polymer samples

	Ingredients in the composite material	Mooney Viscosity ML4-100℃	Micro volume porosity MKM
1	NBR	90/53	7.2
2	PVC	50/53	0.75
3	Astragaus	53/50	4.6 0,12

For the production of rubber compounds, as a result of experimental studies, an optimal formulation was obtained and the obtained data are presented in Table 2

l: Table 2 Comparison between standard and suggested ingredient compositions

Ingredient	Reference composition			Suggested composition	
NBR	100	100	100	93	84
Sulphur	3.5	2.5	2.5	2.5	2.5
Altax	1,5	1,5	0.9	0.9	0.9
Mercapto	0,5	0,5	1.2	1.2	1.2
ZnO	3.5	3.5	3.5	4	4
Neozon-D	2	2	1	1	1
Stearic acid	1.2	1.2	1.2	1	1
Rosin	2.5	2.5	2.5	1.5	1.5
Technical carbon (P-803)	25	25	25	18	18
Technical carbon (P-234)	45	45	45	55	55
Astragaus	-	-	-	10	15

RESULTS AND DISCUSSIONS

Study of geological properties

The rheological properties of the composition were studied in the TIER-4 facility. The results obtained are shown in graphical form in Figures 3-5.

The calculation of melt flow properties of the composition was carried out at different temperatures of 120ºC, 170ºC and 190ºC and under different loads.

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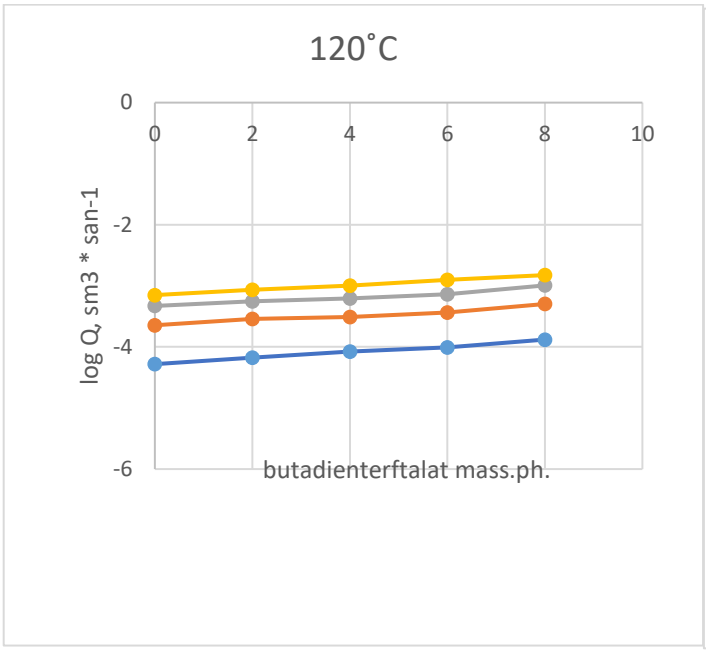


Figure 3. Flow ability index of the composition 190ºC.

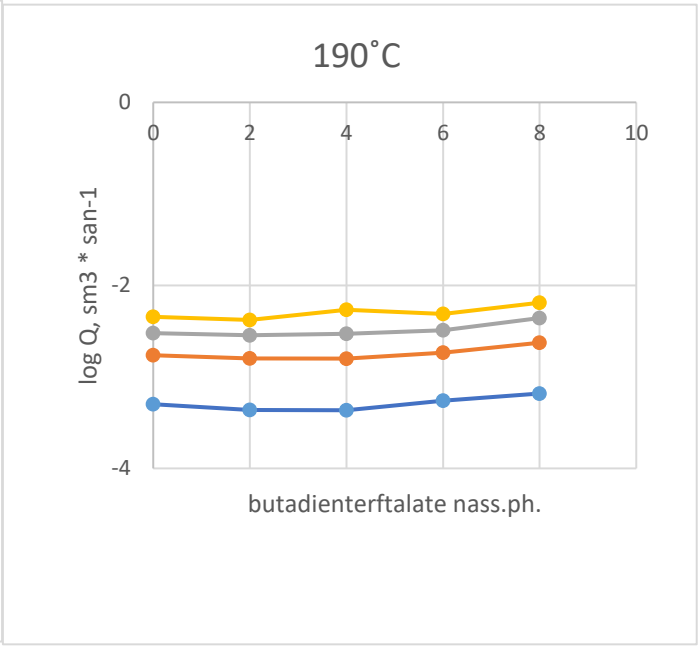


Figure 4. Flow ability index of the attemperaturea120ºC

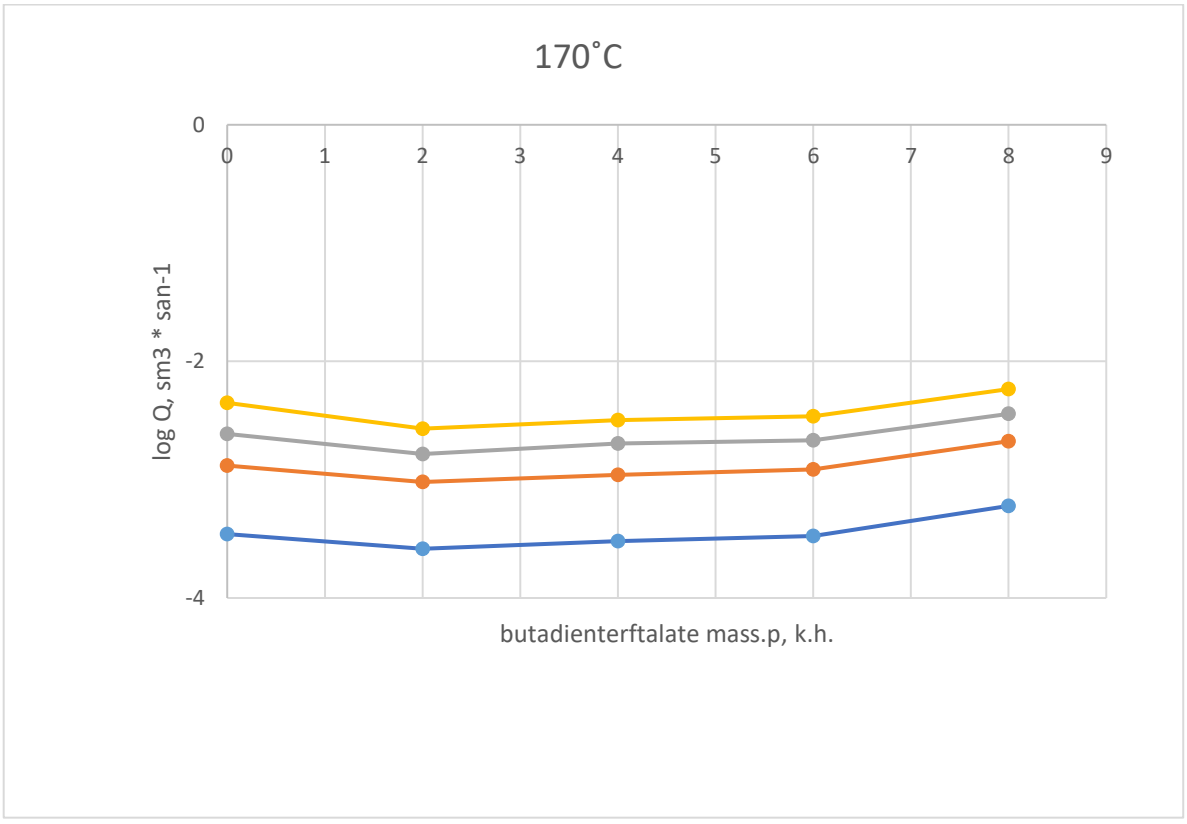
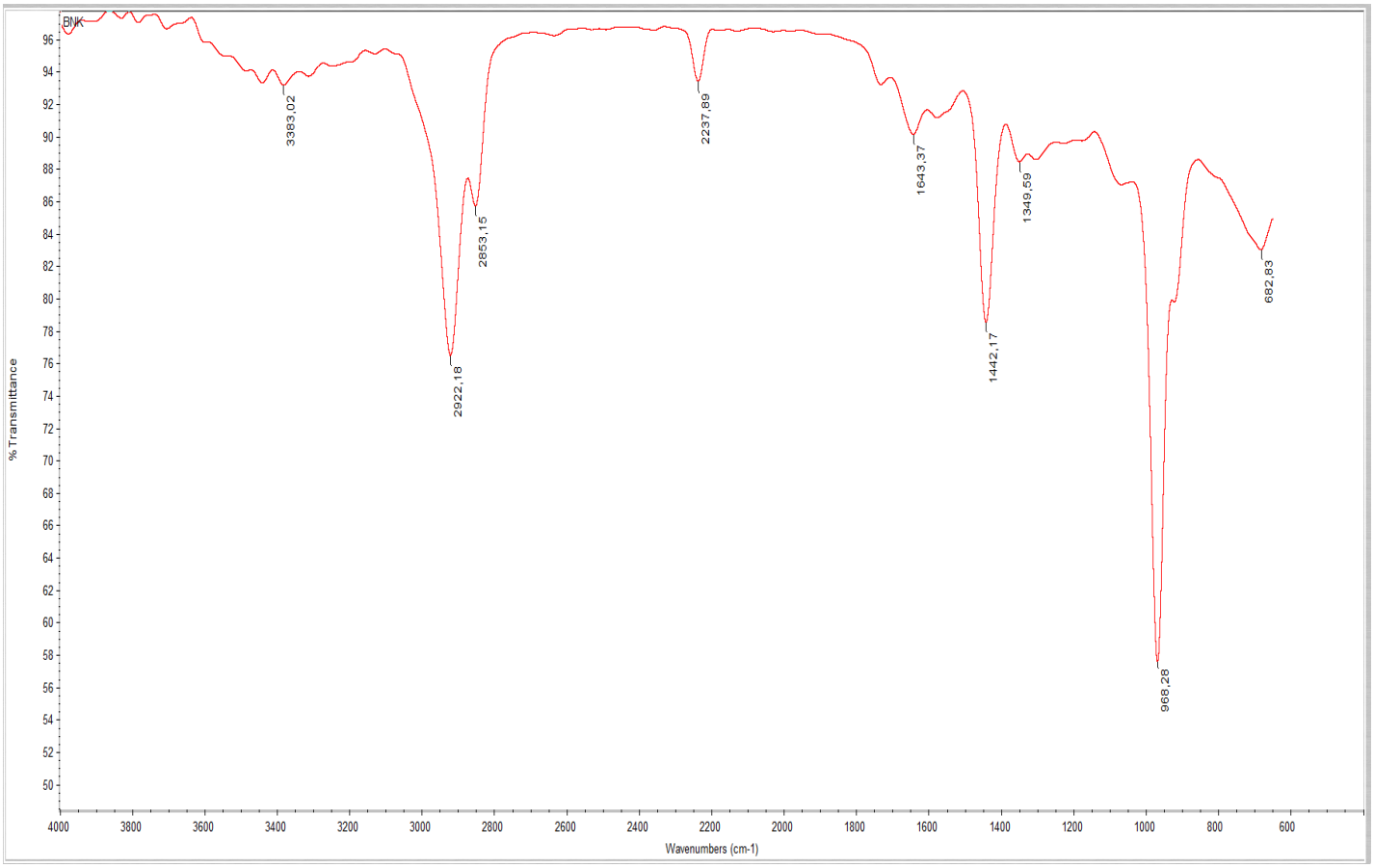


Figure 5. Flow ability index of the at temperature 170ºC

As a result of the analysis, it was determined that astragalus are compatible with butadiene nitrile rubber and can form a composition with it in various proportions. However, it was determined that the best result was obtained when the astragal component in the composition was 10 parts by mass of astragals.

To confirm the modification of NBR with astragals, an IR analysis of this system was performed and the results obtained are given in Figures 6-8

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue IV, April 2026



It is clearly seen in Figure 6, which is also confirmed by the IR analysis. Thus, it can be said with certainty that some properties of this polymer can be eliminated by modifying it with astragals.

Figure 6. IR Spectra of pure NBR sample

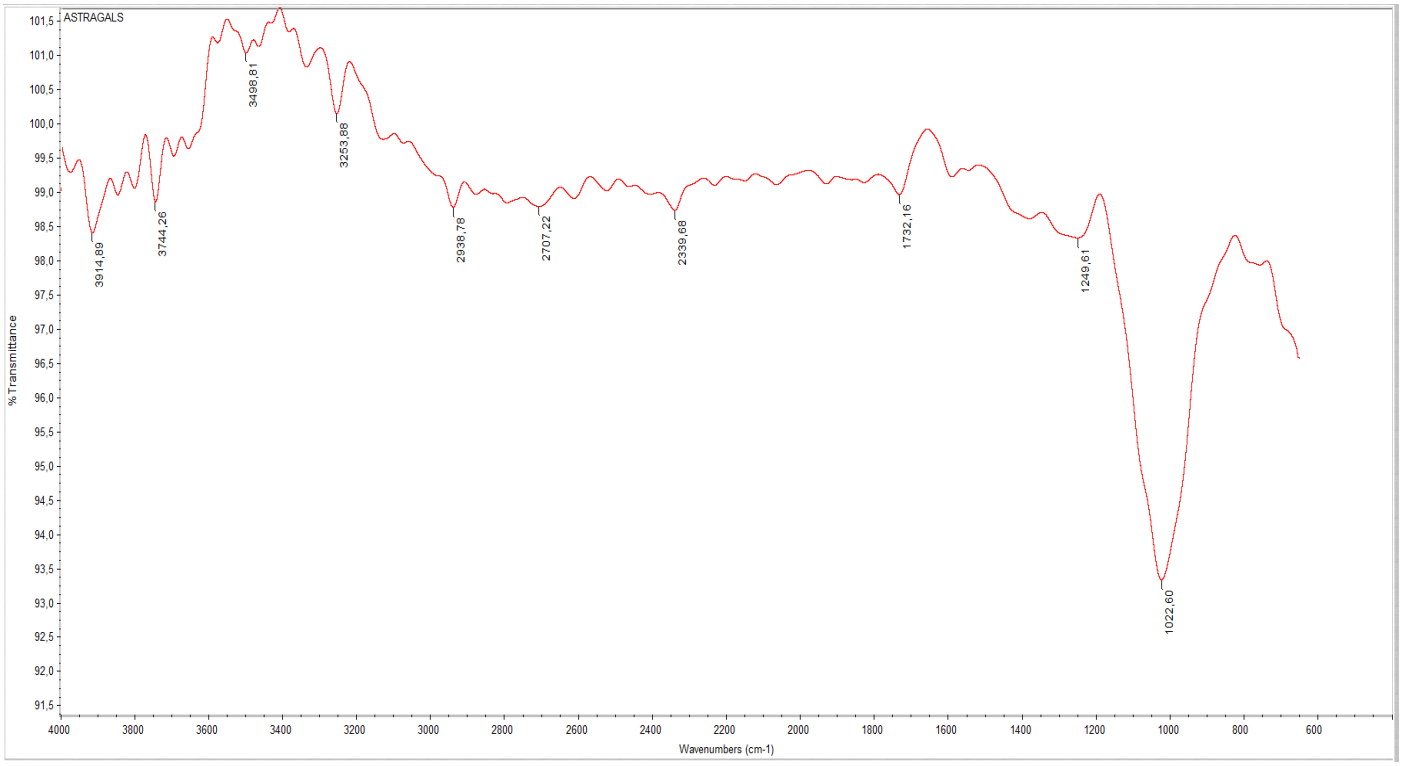


Figure 7. IR Spectra of pure astragals

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue IV, April 2026

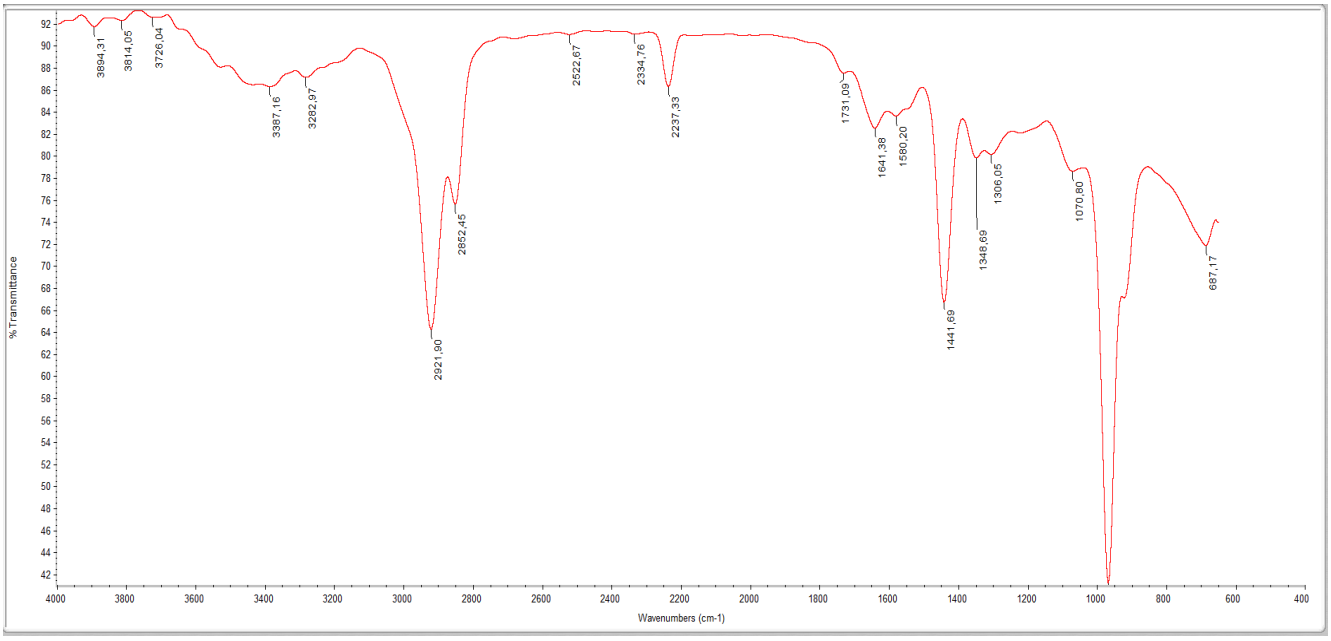


Figure 8 IR Spectra of 10 wt% Astragals incorporated NBR composite sample

Physical properties of resulting composite material based on astragas biopolymer incorporated butadien nitrile rubber (NBR) are represented in the table below (Table 3.):

Table 3. Comparison of physical-mechanical properties vulcanizates

Investigated properties		Sample of reference vulcanizate			Sample of obtained vulcanizate		
1.	Ultimate tensile strength, MPa	19	18,7	18,6	20,3	24,9	22,8
2	Relative elongation, %	325	337	315	390	420	445
3	Relative residual deformation, %	14	16	13	15	15,6	16,7
4	Tear resistance, kN/m	67	65	70	72,4	73,6	74,1
5	Friction resistance, cm3/Wh	61	64	59	66	63	62,7
6	Adhesion to the metal surface, MPa:Steel - 3 Brass	7.4-	7,1 -	7,75,4	10.17,2	11,58,6	12,19,3
7	Brittleness Temperature,^{0}C	14	-	34	31	31	29.5
8	Strength (Measured in TM-2 apparatus), MPa	96	92	88	86	87,2	85,5
11	Reversible deformation, %	14	13	16	16,7	16	15.7

RESULTS

1. The ozone resistance of the obtained rubbers indicates their high chemical stability. Taking this into account, the proposed rubbers can be utilized in the production of products resistant to ozone, oil, and gasoline, and are suitable for operation in aggressive environments.

2. The results of the conducted scientific studies demonstrate that rubbers based on nitrile-butadiene rubber and Astragals nanomaterial can serve as specialty-purpose materials. These rubbers are capable of operating over a wide temperature range and under various climatic conditions. The proposed rubber is NBR-based and can be used in general-purpose optical cables.

3. The proposed composition significantly enhances the adhesion strength of the rubber to metals (Steel-3, brass), improves resistance to gasoline, and increases tensile strength.

4/A composition based on nitrile-butadiene rubber (NBR) has been prepared and studied by incorporating Astragalus-derived components (e.g., extract or filler) into the polymer matrix, followed by vulcanization. The

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue IV, April 2026

studies indicate that this approach can improve properties such as wear resistance and elongation at break. The process involves compounding, subsequent vulcanization using a rubber press, and finally, evaluation of the physical and mechanical properties of the resulting vulcanizates, including abrasion coefficient and relative elongation.

To study the Results

1. By replacing NBR with astragals, it was determined how the modification process affects its mechanical properties.

3. The ozone resistance of the obtained resins showed that they are chemically very stable. Taking this into account, the proposed rubbers can be used in the manufacture of products that are resistant to ozone, oil, gasoline, and can operate in aggressive environments.

4. As a result of scientific research, it has been proven that resins based on nitrile butadiene rubber and astragals nanomaterial can be special-purpose products. These rubbers can operate in a wide temperature range and in different climates. Ours is an NBR-based rubber that can be used for general-purpose optical cables.

5. The proposed composition allows you to significantly increase the strength of the connection of rubber with metals (steel-3, brass), increase resistance to gasoline, and improve the tensile strength index….

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